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Nakamura

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(54) **INKJET RECORDING APPARATUS**

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B41J 2/01	(2006.01)
B41J 29/38	(2006.01)

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CPC ***B41J 25/308*** (2013.01); ***B41J 2/01*** (2013.01); ***B41J 25/3082*** (2013.01); ***B41J 25/3088*** (2013.01); ***B41J 29/38*** (2013.01)

(58) **Field of Classification Search**

CPC B41J 25/308; B41J 25/3082; B41J 25/3088; B41J 25/3084; B41J 25/3086

See application file for complete search history.

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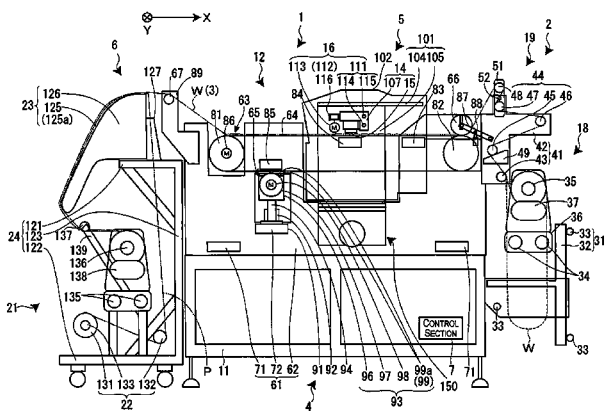
(57) **ABSTRACT**

To provide an inkjet recording apparatus in a simple configuration that can accurately adjust a gap between a nozzle surface of an inkjet head and a recording medium placed on a feed route with simple operations, it is provided with a printing section having an inkjet head and performing printing on a recording medium, an apparatus main body having a pair of side frames that supports the printing section so as to stand the inkjet head face to face with the recording medium and a medium feed mechanism that feeds the recording medium along a feed route, and a gap adjustment section moving the printing section in parallel with respect to the pair of side frames in a separate direction and adjusting a gap between the nozzle surface of the inkjet head and the recording medium placed on the feed route.

6 Claims, 4 Drawing Sheets



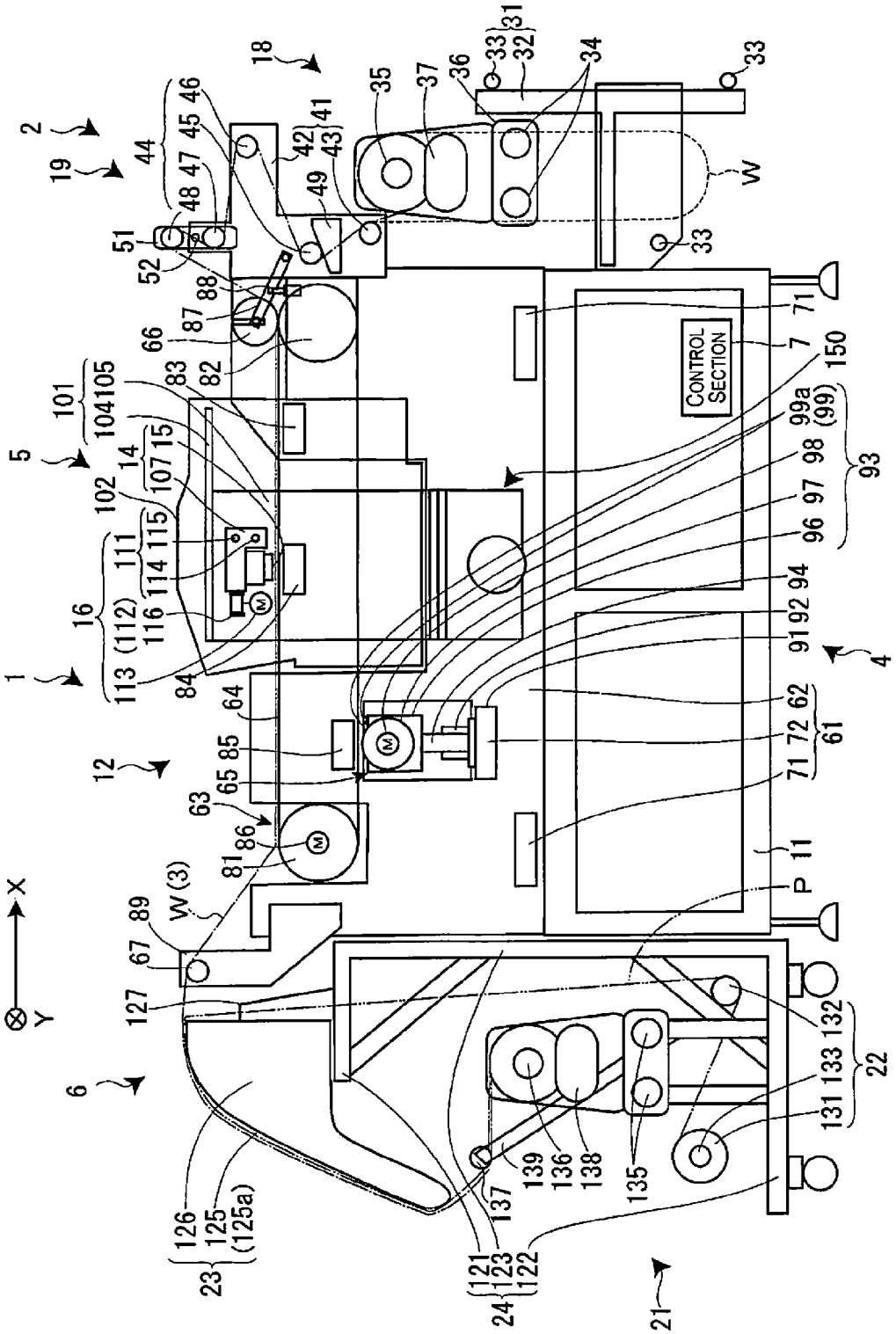


Fig. 1

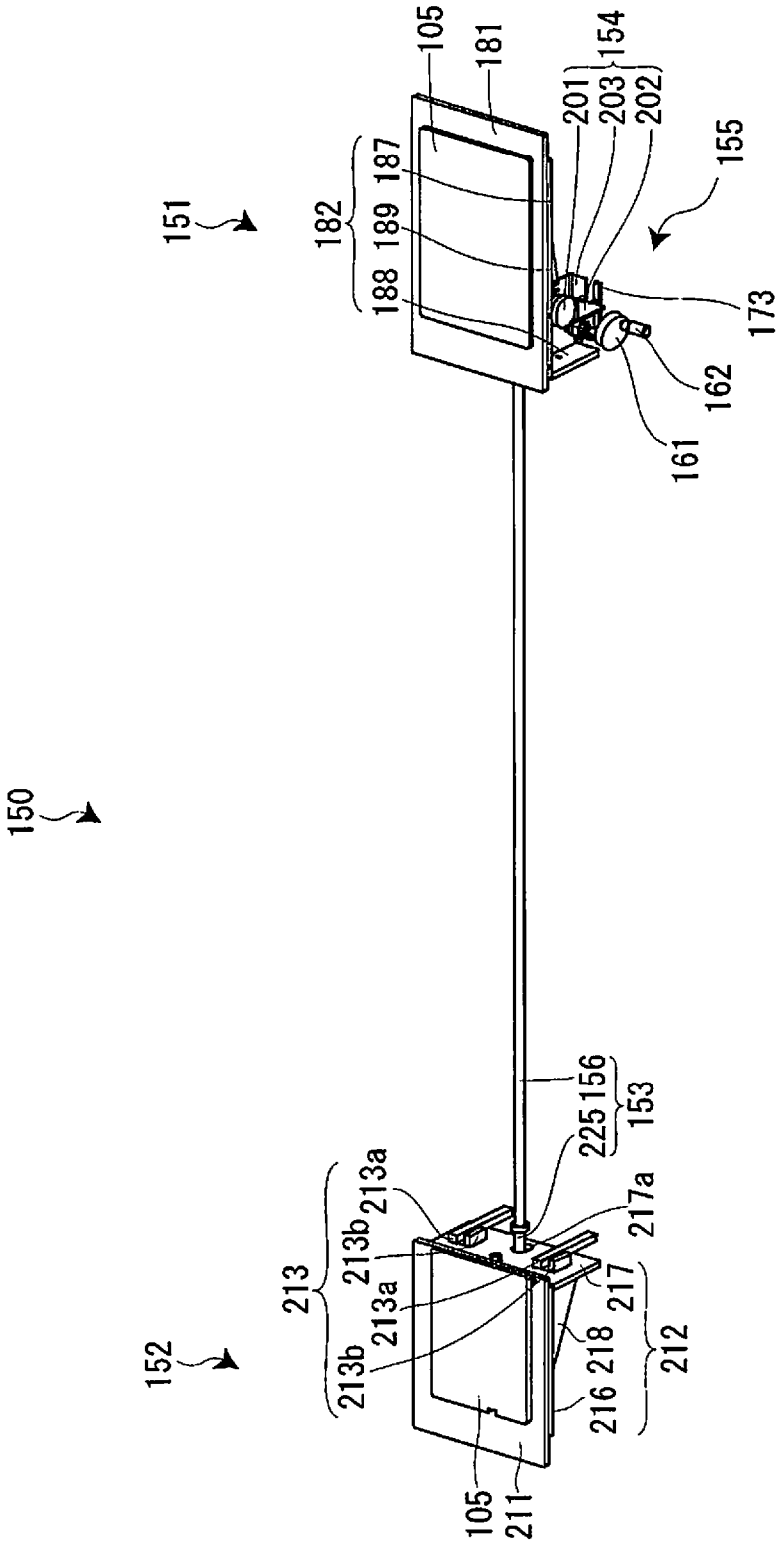

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Fig. 2

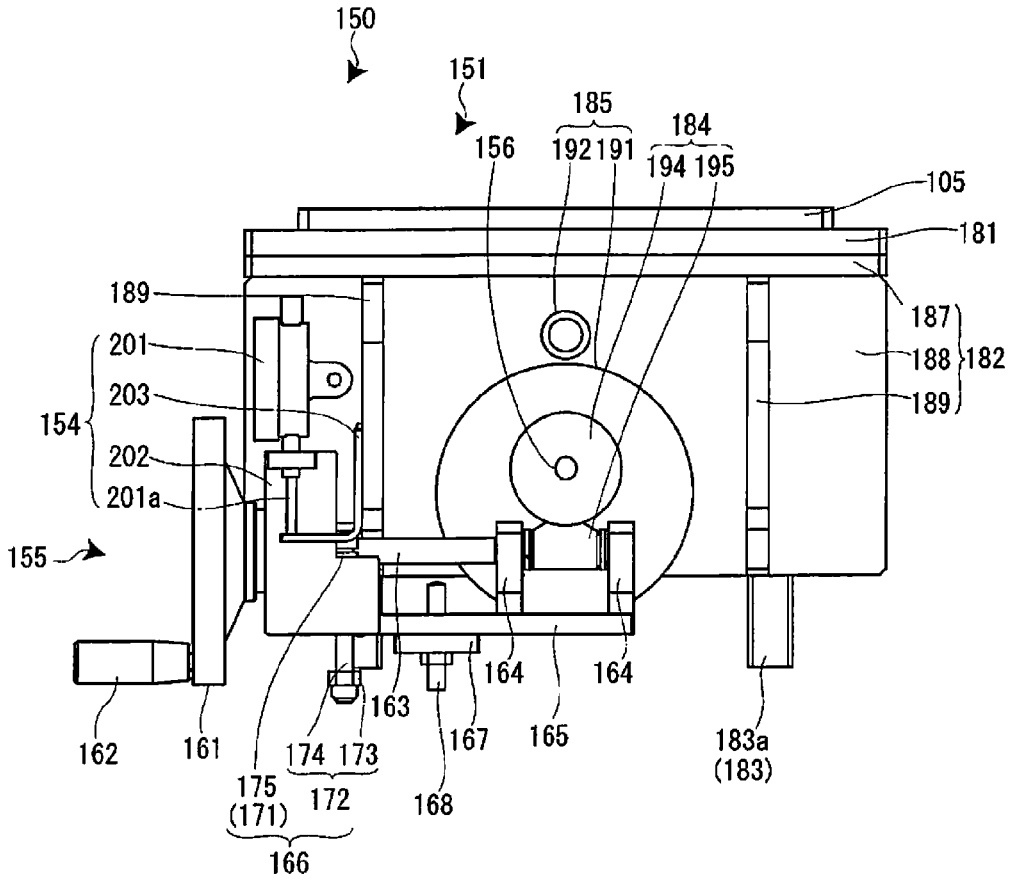
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Fig. 3

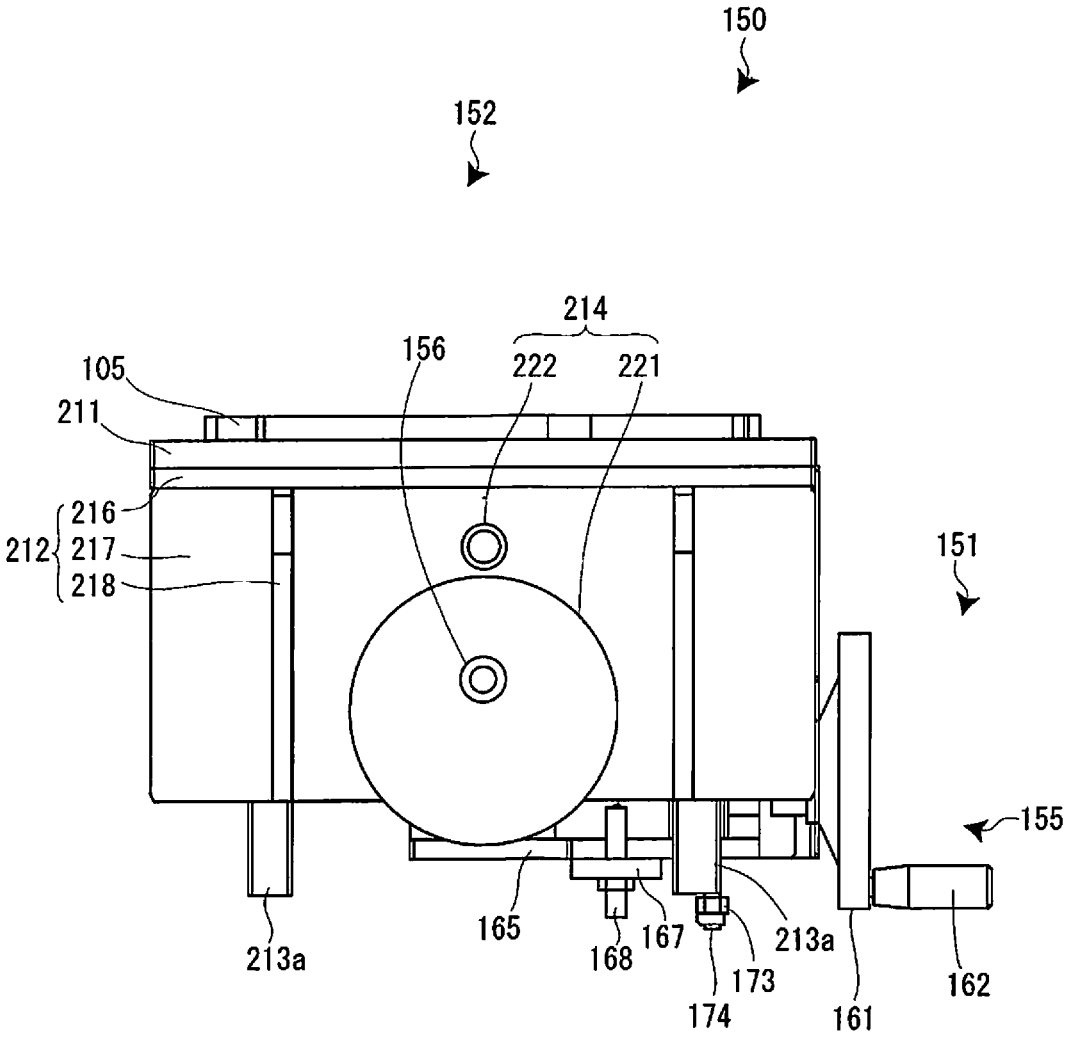
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Fig. 4

INKJET RECORDING APPARATUS

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation application of U.S. patent application Ser. No. 14/011,894 filed on Aug. 28, 2013. This application claims priority to Japanese Patent Application No. 2012-191457 filed on Aug. 31, 2012. The entire disclosures of U.S. patent application Ser. No. 14/011,894 and Japanese Patent Application No. 2012-191457 are hereby incorporated herein by reference.

BACKGROUND

1. Technical Field

The present invention relates to an inkjet recording apparatus having a gap adjustment section that adjusts so-called paper gap.

2. Background Technology

As the inkjet recording apparatuses having this kind of gap adjustment section, it is well known that an image recording apparatus has a unit lifting mechanism that adjusts a gap between a conveyance unit and a recording head by lifting the conveyance unit of a recording medium (see Patent Document 1). This image recording apparatus has a printer main body that performs recording an image to a large-sized recording medium such as a fabric, a resin film, and the like, and a support base that supports the printer main body. The support base has vertical frames, which are arranged on the left and right, and unit support members, which are arranged on the left and right, provided in an internal space of the vertical frames. Also, a pair of the unit lifting mechanisms that lifts the conveyance unit is provided between each vertical frame and each unit support member. The respective unit lifting mechanisms have an operating handle provided in the vertical frame, a pair of lead thread mechanisms that lift the unit support members at two locations before and after (two locations in a feeding direction of a recording medium), and a power transmission device that operates the pair of the lead thread mechanisms. The pair of the lead thread mechanisms has the first rotary shaft and the second rotary shaft forming a male screw respectively, and the respective male screws of the first rotary shaft and the second rotary shaft screw together with a female screw provided in the unit support members. Also, the power transmission device has a gear train that transmits a rotation power of the operating handle to the first rotary shaft and a connecting belt that engages with the first rotary shaft and the second rotary shaft so that they are rotated. In the respective unit lifting mechanisms, when the operating handle rotates and operates, the respective unit support members are lifted through the power transmission mechanism and the pair of the lead thread mechanism. That is, in the main scanning direction of the recording head, the conveyance unit performs height adjustment in the left half by one of the unit lifting mechanisms, and performs height adjustment in the right half by the other unit lifting mechanism. Because of this, a gap between the conveyance unit and the recording head is adjusted in response to the thickness of the recording medium that is introduced.

Japanese Laid-open Patent Publication No. 2005-225041 (Patent Document 1) is an example of the related art.

SUMMARY

In this kind of the conventional image recording apparatus (inkjet recording apparatus), with respect to the recording head (printer main body), there was a configuration that the height adjustment was performed in each left and right half of the conveyance unit so that when a span of the adjustment range was large and the adjustment was performed separately, this became in the state that the male screw and the female screw of the lead thread mechanisms were reciprocally tilted. Thus, it was required to reciprocally or simultaneously adjust the pair of unit lifting mechanisms little by little so that it had a problem that the adjustment operation became complicated. Further, an output terminal of the height adjustment was the lead thread so that it had a problem that it was impossible to perform a fine adjustment in micron order and the printing (recording) quality cannot be improved. In addition, to lift the conveyance unit which is a heavy item, it was required to have a configuration that the support base had two machine stands (stands) that were the unit support member, which directly supports the conveyance unit, and the vertical frame, which indirectly supports the conveyance unit through the unit support member. Therefore, it had a problem that the size of the support base became large and it became complicated.

An advantage of the invention is to provide an inkjet recording apparatus in a simple configuration that can accurately adjust a gap between a nozzle surface of an inkjet head and a recording medium placed on a feed route with simple operations.

An inkjet recording apparatus of the invention includes a printing section having an inkjet head and performing printing on a recording medium; an apparatus main body having an arrangement section that has an arrangement surface in which the recording medium is placed, and a support section that supports the printing section so as to stand the inkjet head face to face with the recording medium; and a gap adjustment section adjusting a gap between a nozzle surface of the inkjet head and the arrangement surface by moving the printing section in parallel with respect to the arrangement surface in a separate direction; wherein the gap adjustment section has a first adjustment section and a second adjustment section that are placed across the arrangement section, an input section that operates the first adjustment section, and an interlock section that interlocks the first adjustment section and the second adjustment section.

In this configuration, a gap adjustment between the nozzle surface and the arrangement surface is performed by the gap adjustment section in a way that the printing section moves in parallel with respect to the apparatus main body in the separate direction. Thus, both structures that support the printing section and the arrangement section can be used as the support section so that the structure can be a compact and simple configuration. Further, the printing section is lighter compare to the arrangement section so that the structure of the gap adjustment section can be simplified and the gap adjustment can be performed with high accuracy by simple operations. Also, the power from the input section can be simultaneously transmitted to the first adjustment section and the second adjustment section by the interlock section so that the printing section can be simultaneously moved in the separate direction. Because of this, it is not required to operate the first adjustment section and the second adjustment section separately. Therefore, the operation for the gap adjustment can be simplified and the gap adjustment can be stabilized. By the way, the separate direction means in a direction that the arrangement surface and the printing section face to each other. For example, when they face to each other in the upper and lower, the direction is a vertical direction (lifting direction), and when they face to each other in the front and back, the direction is a front-back direction.

In this case, it is preferable that the first adjustment section includes a worm that is provided in the support section and is engaged to the input section, a first cam that is provided in the support section and is axially connected to the interlock section, and a first cam follower that is rotatably contacted to the first cam.

In this configuration, the rotative power from the support section is adequately reduced and can be transmitted to the first cam by the worm, and also, the first cam follower can perform micro movement. Because of this, the first adjustment section can be configured in compact, and a gap can be adjusted accurately. By the way, when the span of the adjustable range in the gap adjustment is large, it is not necessary that the displacement (moving distance) of the cam curve of the first cam is required to be a linear with respect to the rotation so that it is preferable to make an appropriate adjustment by the cam curve.

Further, it is preferable that the interlock section includes a shaft that is axially connected to the first cam in one end, and wherein the second adjustment section includes a second cam provided in the support section to which another end of the shaft is axially connected, and a second cam follower that is rotatably contacted to the second cam.

In this configuration, in the same manner as the above description, the rotation power that was reduced can be transmitted to the second cam through the shaft, and also, the second cam follower can perform micro movement by the second cam. Because of this, the second adjustment section can be configured in compact, and a gap can be accurately adjusted.

In this case, it is preferable that the first cam and the second cam are configured by an eccentric cam, respectively.

In this configuration, the first cam and the second cam can be easily formed (manufactured). Also, a cam surface (cam curve) of the eccentric cam is a circular form so that the displacement with respect to the rotation in the arc part near the axis and in the arc part far from the axis becomes fine, and the displacement with respect to the rotation in the middle of the arc part becomes rough. On the other hand, recording mediums have plural types in different thickness. Accordingly, it is preferable to determine which part of the arc part is used by taking the plural types of recording mediums in different thickness into consideration. By the way, to interlock the first cam and the second cam accurately, it is preferable that the first cam and the second cam are manufactured by producing its cam surface and its shaft hole at the same time. Also, it is preferable that the shaft is manufactured by producing its both end parts and its axial attachment part at the same time.

Further, it is preferable that the input section has an operating handle for manual operation connected to the worm, and a lock mechanism that locks the operating handle in any rotation position.

In this configuration, after the gap adjustment, the operating handle is locked by the lock mechanism so that it is effectively prevented from deviation of the gap due to the vibration, and the like. By the way, it is preferable that the lock mechanism has a configuration to clamp a shaft of the operating handle and release clamping.

On the other hand, a gap measurement section that measures a dimension of a gap is also provided. It is preferable that in the support section, the gap measurement section includes a dial gauge, in which a measuring element is provided in a contact direction of the separate direction, and a contact piece that is provided in the first adjustment section and contacts to the measuring element of the dial gauge.

In this configuration, the dial gauge attached to the support section is attached in the contact direction of the separate direction so that a spindle (measuring element) of the dial gauge contracts when the gap becomes larger, and expands when the gap becomes smaller. Therefore, the measurement value of the dial gauge becomes a form of use to display a dimension of a direct gap so that the gap adjustment can be performed without any mistake.

BRIEF DESCRIPTION OF THE DRAWINGS

Referring now to the attached drawings which form a part of this original disclosure:

FIG. **1** is a cross-section structural diagram schematically showing an inkjet recording apparatus according to an embodiment;

FIG. **2** is a perspective view of a gap adjustment section as a whole;

FIG. **3** is a front view of a left adjustment section of the gap adjustment section; and

FIG. **4** is a front view of a right adjustment section of the gap adjustment section.

DETAILED DESCRIPTION OF EXEMPLARY EMBODIMENTS

Herein after, an inkjet recording apparatus according to one embodiment of the invention will be described in reference to the attached drawings. This inkjet recording apparatus prints (textile printing) a pattern, and the like on a fabric (original fabric) that removes the supplied material in so-called reel-to-reel format by using dye ink exclusively in the inkjet method. By the way, in the description below, it is defined that a forward and reverse feed direction of a recording medium, which is a fabric, is the direction of the X axis. Also, it is defined that a direction intersecting the direction of the X axis is the direction of the Y axis. Further, it is defined that a direction intersecting the direction of the X axis and the direction of the Y axis is the direction of the Z axis.

FIG. **1** is a cross-section structural diagram of an inkjet recording apparatus. As shown in the drawing, the inkjet recording apparatus **1** is provided with a feed section **2** that feeds and sends a recording medium W, which is rolled in a roll shape, an apparatus main body **4** that sends the fed recoding medium W along a feed route **3** for printing, a printing section **5** that is placed upper side of the apparatus main body **4** and performs printing to the recording medium W by the inkjet method in cooperation with the apparatus main body **4**, a winding section **6** that takes up and collects the recording medium W printed by the printing section **5** in the downstream side of the feed direction of the apparatus main body **4**, and a control section **7** that totally controls these components.

The apparatus main body **4** is provided with a machine stand for main body **11** that is configured by combining steel materials, a medium feed mechanism **12** that is supported by the machine stand for main body **11** and intermittently feeds the recording medium W by a belt conveyance in the direction of the X axis. The printing section **5** is provided with a carriage unit **14** that has an inkjet head **15**, and a head moving mechanism **16** that reciprocates the carriage unit **14** in the direction of the X axis. On the other hand, the feed section **2** is provided with a feed unit **18** that feeds the

recording medium W, and a slack removing unit **19** that removes slack of the fed recording medium W. Also, the winding section **6** is provided with a winding unit **21** that winds the recording medium W, an interleaf unit **22** that supplies an interleaf P to the winding unit **21**, and a heater unit **23** that vaporizes solvent (fluid) of dye ink soaked in the recording medium W before winding the recording medium W, and it has a configuration that these components are mounted on a machine stand for winding section **24**.

A slack of the recording medium W (fabric) fed from the feed unit **18** is removed so as to be stretched by the slack removing unit **19** and the recording medium W is fed to the medium feed mechanism **12**. The recording medium W fed to the medium feed mechanism **12** is adhered to a surface and conveyed by the belt. In this belt conveyance, the recording medium W is intermittently fed in the direction of the X axis (sub-scanning). On the other hand, synchronizing with this, the carriage unit **14** reciprocates in the direction of the Y axis and the ink is discharged from the inkjet head **15** (main scanning).

After a printing was performed in this way, a part of the recording medium W where the printing has already been done (printed part) is fed to the winding section **6** from the medium feed mechanism **12**. In the winding section **6**, an interleaf P is continuously supplied from the interleaf unit **22** to the recording medium W fed from the medium feed mechanism **12** so that the recording medium W and the interleaf P are overlapped and they are fed to the heater unit **23**. In the heater unit **23**, the recording medium W is heated with the interleaf P and the solvent (fluid) of the dye ink is vaporized. Because of this, the printed recording medium W that was dried is wound in the winding unit **21** with the interleaf P.

As shown in FIG. **1**, the feed unit **18** is provided with a feed frame **31** that consists of a pair of T-shaped frames **32**, which are arranged on the left and right (direction of the Y axis), fixed in the above described machine stand for main body **11** and a plurality of rod-shaped frames **33** across between the pair of T-shaped frames **32**, two feed-side rod bases **34** that extend in the direction of the Y axis and support the pair of T-shaped frames **32** in both ends, and a pair of feed shaft protrusions **35** that is slidably supported by the two feed-side rod bases **34**. A tip of the respective feed shaft protrusions **35** forms a truncated cone shape. The pair of feed shaft protrusions **35** horizontally supports the recording medium W by bringing them near each other in the width corresponding to the width of the recording medium W and fitting the respective tips to the core of the roll-shaped recording medium W.

In the pair of feed shaft protrusions **35**, a width movement unit **36** driven by a motor is respectively provided. When a winding slippage in the axial direction is caused in the recording medium W (detection), the pair of feed shaft protrusions **35** performs micro movement on the two feed-side rod bases **34** so that it is prevented from a position misalignment in the width direction with respect to the medium feed mechanism **12** of the recording medium W. That is, it is prevented from meandering (skew) the recording medium W in the medium feed mechanism **12**.

Also, in one of the pair of feed shaft protrusions **35**, a rotation unit **37** driven by a motor is provided. By the rotation unit **37**, the recording medium W is fed by rotating the pair of feed shaft protrusions **35**. In the present embodiment, there are a tension mode that feeds the recording medium W with a certain tension and a loosening mode that feeds the recording medium W by reducing tension as much as possible so that a mode switch is performed depending on a different recording medium W.

In the tension mode, this is used for a normal fabric (recording medium W) having a low elongation and contraction property, and in this case, in the control system of the rotation unit **37**, the control section **7** controls the rotation unit **37** to take a load (tension) so that the load becomes a predetermined value. On the other hand, in the loosening mode, this is used for a fabric (recording medium W) having a high elongation and contraction property such as, for example, stocking material. In this case, the fed recording medium W is once loosened on the lower side (indicating in a broken line in FIG. **1**), and it controls the recording medium W is sent to the slack removing unit **19**. Specifically, a lower part of the loosened recording medium W is detected so that when the loosening of the lower part is largely crossed over a predetermined position, the feed operation of the recording medium W by the rotation unit **37** is stopped.

The slack removing unit **19** is provided with a slack removing frame **41** that consists of a pair of L-shaped frames **42**, which are arranged on the left and right (direction of the Y axis), fixed in a side frame **62** of the medium feed mechanism **12**, which will be described later, and a rod frame **43** across between the pair of L-shaped frames **42**, and a roller group **44** that is rotatably supported by the pair of L-shaped frames **42** in the both ends. The roller group **44** is provided with the first roller **45**, the second roller **46**, the third roller **47**, and the fourth roller **48** in the order from the upstream side in the feed direction so that the feed route **3** of the recording medium W fed from the feed unit **18** is bent at a plurality of locations.

The first roller **45** is configured by a roller having high coefficient of friction, and the both ends of the first roller are mounted on a pair of inclined blocks **49** that is attached on the inner side of the respective L-shaped frames **42**. In the state that the upstream side of the recording medium W has got loose, the route is changed diagonally outward toward the second roller **46** at the section of the first roller **45**. The recording medium is pulled (fed) by the intermittent feed of the medium feed mechanism **12**, and the first roller **45** moves as to climb the pair of inclined blocks **49** by the friction force between the recording medium W and the first roller **45**. Also, when feeding the recording medium W stops, the first roller **45** goes down the pair of inclined blocks **49** by its own weight so as to return to the original position. Because of this, an appropriate tension is given to the recording medium W that is going to be fed, and a shock of the intermittent feed is absorbed.

The recording medium W that passes the first roller **45** makes a U-turn at the second roller **46** and reaches to the third roller **47** and the fourth roller **48**. The third roller **47** and the fourth roller **48** are vertically provided in the vicinity to each other, and are rotatably supported by the pair of bearings **51** in which the both ends integrally formed. Also, the respective bearings **51** are rotatably supported by the L-shaped frames **42**, and in one of the bearings **51**, an angle adjustment unit **52** that adjusts a set angle of the third roller **47** and the fourth roller **48** in vertical is provided.

A route for the recording medium W that passes the third roller **47** and the fourth roller **48** is changed to the "S" shape, but the "S" shape is adjustably changed in response to the type of the recording medium W so that an appropriate tension can be given depending on a different type of the recording medium W. Because of this, a slack or a crinkle portion is removed and the recording medium W is fed to the medium feed mechanism **12**. By the way, it is preferable that

these rollers **45**, **46**, **47**, **48** have a convex shape so that a component force is functioned to the recording medium W outward from the center thereof.

As shown in FIG. **1**, the medium feed mechanism **12** is provided with a main body frame **61** that has the pair of side frames **62**, which are arranged on the left and right (direction of the Y axis), mounted and fixed on the above described machine stand for main body **11**, a belt conveyance unit **63** that is supported by the pair of side frames **62** and has an endless conveyance belt **64**, and a belt washing unit **65** that is provided in the lower side of the belt conveyance unit **63**. Also, the medium feed mechanism **12** is provided with a pressing roller **66** that engages to the belt conveyance unit **63** from upper side in the upstream side, and a separating roller **67** that is provided diagonally upward with respect to the belt conveyance unit **63** in the downstream side.

The main body frame **61** is provided with the pair of side frames **62** that is configured by a thick board, and a pair of coupling frames **71** that are arranged the front and back (direction of the X axis) and couples the pair of side frames **62** so that it is mounted and fixed on the machine stand for main body **11** by the pair of side frames **62**. Also, the pair of the coupling frames **71** is sandwiched in between the pair of side frames **62** so that they are coupled, and the main body frame **61** has a support frame **72** to support the above described belt washing unit **65**. In the respective side frames **62**, a notch for mounting the belt conveyance unit **63** and a notch for mounting the printing section **5** are arbitrarily provided, and an opening section is formed to check the belt washing unit **65**.

The belt conveyance unit **63** is provided with a drive pulley **81** that is located in the downstream side of the feed direction, a driven pulley **82** that is located in the upstream side of the feed direction, and an endless conveyance belt **64** that bridges between the drive pulley **81** and the driven pulley **82**. Also, the belt conveyance unit **63** is provided with a first guide plate**83** that is located near the driven pulley **82** and guides to drive the conveyance belt **64**, a second guide plate **84** that is located directly below the printing section **5** and guides to drive the conveyance belt **64**, and a third guide plate **85** that is located directly below the above described support frame **72** and guides to drive the conveyance belt **64**, which traveled around the back side.

In the state that the mutual surfaces of the first guide plate **83** and the second guide plate **84** are arranged so as to become a flush surface (the same horizontal surface), the pair of side frames **62** are bridged so that it is functioned as a part of the main body frame **61**. Also, the first guide plate **83** guides the conveyance belt **64** (of the upper side) immediately after leaving from the driven pulley **82** so that it is driven horizontally, and the second guide plate **84** guides the conveyance belt **64** (of the upper side) located in a print area without any slack. Therefore, the conveyance belt **64** located directly above the second guide plate **84** functions as a platen. In addition, the third guide plate **85** guides the conveyance belt **64** so as to press the push-up power received from the belt washing unit **65** (the detail will be described later).

The drive pulley **81** and the driven pulley **82** are rotatably supported by the pair of side frames **62** through the dedicated bearing, and one axial end of the drive pulley **81** couples to a conveyance motor **86** to intermittently drive the conveyance belt **64**. The conveyance belt **64** is configured by a wide special belt that has adhesiveness (adhesion process) on the outer periphery (surface) so that the recording medium W is stuck and fed in the direction of the X axis. Because of this, in directly below the printing section **5**, the recording medium W is fed for a printing (intermittent feed) without causing burr, and the like.

In the upper side of the driven pulley **82**, the pressing roller **66** that sticks the recording medium W, which was fed from the slack removing unit **19**, to the conveyance belt **64** is provided. The pressing roller **66** is rotatably supported by a tip part of a pair of support arms **87** that are rotatably supported by the side frames **62**. Also, the pressing roller **66** has a predetermined elasticity and own weight, and by its own weight, it presses the recording medium W to the conveyance belt **64** in directly above the driven pulley **82**. That is, the pressing roller **66** and the driven pulley **82** sandwiches the conveyance belt **64** and functions as a nip roller so that the recording medium W is continuously stuck on the conveyance belt **64** that is driven. By the way, in the intermediate position of the respective support arms **87**, an air cylinder **88** is coupled for rotating the support arms **87**, and the pair of air cylinders **88** is synchronously driven so that the pressing roller **66** is separated from the conveyance belt **64**.

On the other hand, in a position diagonally upward the drive pulley **81**, the separating roller **67** feeding to the winding section **6** is provided to separate the recording medium W from the conveyance belt **64** after the printing. The separating roller **67** is rotatably supported by a pair of sub-frames **89** extending from the side frames **62**. In this case, the separating roller **67** relatively separates the recording medium W from the conveyance belt **64** that circles around and goes around to the back side of the drive pulley **81**, but in an actual operation, a separation power from the conveyance belt **64** is different depending on a type of the recording medium W. Because of this, depending on a type of the recording medium W, there is a case that the separation starts in a position where the conveyance belt **64** starts the round, or there is a case that the separation starts in a position where the round has progressed to certain extent. However, when a point of the separation goes round on the back side, it is likely to get the recording medium W caught in the conveyance belt **64**.

Accordingly, in the present embodiment, an angle of the recording medium W fed from the conveyance belt **64** to the separating roller **67** is detected, and the winding unit **21** is driven to wind based on the detection result of the position detection so that it prevents a point of the separation from going round on the back side of the conveyance belt **64**.

As shown in FIG. **1**, the belt washing unit **65** is supported by the above described support frame **72** in the lower side of the conveyance belt **64**, and extends in the direction of the Y axis as to cross the conveyance belt **64**. The belt washing unit **65** is provided with a unit base **91** that is mounted on the support frame **72**, a lifting cylinder **92** that is provided so as to stand in the unit base **91**, a washing unit main body **93** that is lifted by the lifting cylinder **92**, and a pair of lifting guides **94** that guides to move up and down the washing unit main body **93**.

Further, the washing unit main body **93** is provided with a boxlike washing container **96** that extends in the direction of the Y axis and reserves wash solution, a rotating brush **97** that is stored in the washing container **96**, a washing motor **98** that rotates the rotating brush **97**, and a wiper **99** that relatively wipes out the wash solution sticking on the conveyance belt **64**. The wiper **99** is disposed inside of the wash container **96**, and is configured by two wiping blades **99***a* provided in "V" shape, and contacts to the conveyance belt **64** that is driven so as to wipe out the wash solution. By the way, ultimately remaining wash solution on the convey-

ance belt **64** is wiped out by a waste cloth. Also, it is preferable that the wash solution is circulated while filtering in between the external tank.

In the conveyance belt **64** having adhesiveness, lint or dust is adhered depending on time so that the washing to the conveyance belt **64** by the belt washing unit **65** is performed periodically. In the washing operation, after lifting the washing unit main body **93** to the position where the rotating brush **97** and the wiper **99** contact to the conveyance belt **64**, the conveyance belt **64** is driven and the rotating brush **97** is rotated in the direction opposite to the driving direction of the conveyance belt. In this time, the conveyance belt **64** is pressed by the above described third guide plate **85**, and contacts with the rotating brush **97** while maintaining the horizontal-position. Because of this, the conveyance belt **64** (of adhesive surface) is continuously washed by brushing. By the way, after the washing, it is preferable to perform an adhesion process to recover the adhesion of the conveyance belt **64**.

As shown in FIG. **1**, the printing section **5** is provided with a printer frame **101** that extends in the direction of the Y axis to stride over the feed route **3** (belt conveyance unit **63**), a head moving mechanism **16** that is supported by the printer frame **101**, a carriage unit **14** that reciprocates the head moving mechanism **16** in the direction of the Y axis, and a printer cover **102** that covers these components. Also, it is not specifically drawn, but in the printing section **5**, a cap unit and a cleaning unit that maintain the inkjet head **15** are provided. By the way, so-called paper gap (workpiece gap) in the printing section **5** has a range of thickness in various recording mediums W so that it is adjusted by lifting entire printing section **5** with respect to the apparatus main body **4** (medium feed mechanism **12**).

As shown in FIG. **1**, the printer frame **101** is provided with a beam-shaped frame **104** made of the sheet metal that extends in the direction of the Y axis and a pair of stand frames **105** made of the sheet metal that supports the beam-shaped frame **104** in the both ends. In the pair of stand frames **105**, the above described side frames **62** are supported. By the way, the printer cover **102** is mounted on this printer frame **101**.

A carriage unit **14** is provided with the inkjet head **15** that has plural colors of nozzle lines for color print and a carriage **107** that holds the inkjet head **15** in which the nozzle surface is facing down. By the way, each color of dye inks supplied to each nozzle line is supplied from so-called off-carriage ink tank.

The head moving mechanism **16** is provided with a carriage guide **111** that slidably supports the carriage unit **14** in a cantilever in the direction of the Y axis, a belt conduction mechanism **112** that reciprocates the carriage guide **111**, and a carriage motor **113** that drives the belt conduction mechanism **112**. The carriage guide **111** is composed of a main guide **114** in a lower side and a sub-guide **115** in an upper side. The main guide **114** and the sub-guide **115** support the above described pair of stand frame **105** in its both ends. The belt conduction mechanism **112** is provided with a timing belt **116**, and a part of the timing belts **116** is fixed to the carriage unit **14** (carriage **107**).

When the timing belt **116** is reciprocally driven by a carriage unit **14**, the carriage guide **111** is guided to reciprocate in the direction of the Y axis. A moving position of the carriage guide **111** is detected by a linear encoder, and each color of the dye inks is selectively discharged from the inkjet head **15** based on the detection result and the print data. Because of this, the printing (textile printing) to the recording medium W is performed.

As shown in FIG. **1**, the winding section **6** is provided with the machine stand for winding section **24** that detachably couples to the machine stand for main body **11** in the direction of the X axis, the heater unit **23** that is supported by the upper part of the machine stand for winding section **24**, the winding unit **21**, and the interleaf unit **22** that are supported by the lower part of the machine stand for winding section **24**. For the printed recording medium W, there is a method for directly winding a thick recording medium W, which does not get ink offset, and there is a method for winding a thin recording medium W, which easily gets ink offset, overlapped with an interleaf P. It has a design available to any method. The case that the latter method is employed will be described below.

The machine stand for winding section **24** is provided with an upper horizontal frame section **121**, a lower horizontal frame section **122**, and a vertical frame section **123** that couples the upper horizontal frame section **121** and the lower horizontal frame section **122**. They are configured by lengthwise and breadthwise combining the extruded shape materials of aluminum. And, the vertical frame section **123** is detachably coupled to the machine stand for main body **11**.

The heater unit **23** is provided with a heat release plate **125** that has an arc-like heat release surface **125***a*, and a heater **126** that is attached inside in the heat release plate. Also, in the state that the upper half section of the heater unit **23** is mounted on the upper horizontal frame section **121**, the heater unit **23** is fixed to the upper horizontal frame section **121** by left and right fixing members **127** provided in the upper horizontal frame section **121**. The top end of the heat release plate **125** is provided in a position that is adjacent to the above described separating roller **67** and is slightly lower than the separating roller **67**. Also, the top end of the heat release plate **125** is bent in an arc shape, which is facing down, to change a route for an interleaf P introduced from the lower side of this section.

The recording medium W that passed the separating roller **67** overlaps with the interleaf P fed from the lower side in the top end of the heat release plate **125** and is fed to the lower side along the arc-shaped outer surface (heat release surface **125***a*) of the heat release plate **125**. The recording medium W and the interleaf P that are vertically fed by slidably contacting to the heat release surface **125***a* are continuously heated by the heater **126**. By this heat, the solvent (fluid) of the dye ink soaked in the recording medium W is vapored so that the dye is fixed to the fabric.

The interleaf unit **22** is provided with an interleaf roller **131** that feeds a roll-shaped interleaf P, and a guide bar **132** that changes a route of the fed interleaf P toward the top end of the heat release plate **125**. The guide bar **132** is fixed in a part of a diagonal member that couples between the lower horizontal frame section **122** and the vertical frame section **123**. Also, the interleaf roller **131** is supported in the front part of the lower horizontal frame section **122** through the pair of bearing units **133** that is provided with a damping mechanism. The interleaf P is fed without causing any slack by the pair of bearing units **133**.

The winding unit **21** is supported by the rear section of the lower horizontal frame section **122** in the same manner as the above described feed unit **18**. The winding unit **21** is provided with two winding side rod bases **135** that extend in the direction of the Y axis, and a pair of winding shaft projections **136** that is slidably supported by the two winding side rod bases **135**. Also, the winding unit **21** is located in the feed route **3** between the bottom end of the heat release plate **125** and the pair of winding shaft projections **136**, and

has a tension roller **137** that gives a tension to the recording medium W and the interleaf P.

The top end of the respective winding shaft projections **136** is formed in a truncated cone shape, and the respective top ends of the pair of winding shaft projections **136** are engaged to the winding core winding the recording medium W by mutually aligning the width of the recording medium W so that it is horizontally maintained. One side of the pair of winding shaft projections **136** provides a rotation unit **138** driven by a motor so that the pair of winding shaft projections **136** is rotated and the recoding medium W and the interleaf P are simultaneously wound. Further, in the position adjacent to the separating roller **67** as described above, the rotation unit **138** is controlled based on the angle detection of the recording medium W fed to the separating roller **67**.

A tension roller **137** is rotatably supported by the end part of a pair of turn arms **139** that is rotatably supported in the rear part of the lower horizontal frame section **122**. And, the tension roller **137** rotationally contacts to the interleaf P side of the recording medium W, which is wound in the winding core, and the interleaf P. The recording medium W and the interleaf P are biased so as to turn to the lower side by the own weight of the tension roller. Because of this, an appropriate tension is given to the recording medium W and the interleaf P, and the recording medium W and the interleaf P are wound in the winding core.

Next, a gap adjustment section **150** that adjusts so-called paper gap of the inkjet head **15** will be described in reference to FIG. **2** and FIG. **4**. As described above, a paper gap (workpiece gap) in the printing section **5** is adjusted by lifting entire printing section **5** with respect to the apparatus main body **4** (medium feed mechanism **12**). Also, for the recording medium W, an extreme thick recording medium (8 mm in the maximum thickness) is assumed. For this reason, the left part (front side in FIG. **1**) and the right part (back side in FIG. **1**) of the gap adjustment section **150** are simultaneously lifted (parallel shift) in respect to the printing section **5** that is provided to stride over the feed route **3** (belt conveyance unit **63**). By the way, the phrase "arrangement section" called in the claims is configured by the conveyance belt **64** (belt conveyance unit **63**), and the word "arrangement surface" is configured by the surface of the conveyance belt **64**. Also, the phrase "separate direction" called in the claims is the direction of lifting the printing section **5**.

As shown in FIG. **2**, the gap adjustment section **150** is provided with a left adjustment section **151** (the first adjustment section) that lifts one end part (left part) of the printing section **5**, a right adjustment section **152** (the second adjustment section) that lifts the other end part (right part) of the printing section **5**, an interlock section **153** that has a connecting shaft **156** to interlock the adjustment operation of the left adjustment section **151** and the right adjustment section **152**, and a gap measurement section **154** that measures and displays a gap dimension according to the gap adjustment. Also, the gap adjustment section **150** is provided with the interlock section **153** so that it is provided with a manual operation input section **155** to adjust one of the left adjustment section **151** and the right adjustment section **152** (it is the left adjustment section **151** in the embodiment). By the way, the gap measurement section **154** is also provided in the left adjustment section **151** side.

As shown in FIG. **2** and FIG. **3**, the input section **155** is provided with a wheel-shaped operating handle **161** that has a grip **162**, a handle shaft **163** that mounts to the operating handle **161**, two radial bearings **164** that rotatably supports the handle shaft **163**, a handle base **165** that supports the operating handle **161** through the two radial bearings **164** and the handle shaft **163**, and a lock mechanism **166** that locks and unlocks the rotation of the handle shaft **163**. And, in the handle shaft **163**, a worm **195**, which will be described later, is mounted and is located between the two radial bearings **164**.

The operating handle **161** exposes to outside, and a paper gap is adjusted by forward and reverse rotation by the grip **162**. By the way, the input section **155** in the embodiment is driven by manual, but it can be driven by a motor. The handle base **165** forms a rectangular shape along the handle shaft **163**, and is supported by the above described side frames **62** (bottom end part of the left side of the side frames **62**). Also, in the installing block **167**, a stopper thread **168** screws together so as to penetrate the installing block. The bottom end of the perpendicular plate **188**, which will be described later, contacts to the end (top end) of the stopper thread **168** so that a position in the lower movement of the gap adjustment is controlled. Because of this, even when the handle operation is performed in error, the nozzle surface of the inkjet head **15** does not contact to the surface of the conveyance belt **64**.

The lock mechanism **166** locks and unlocks the rotation of the handle shaft **163** by clamping the handle shaft **163** and releasing the clamping of the handle shaft **163** so that it is provided with a mechanism main body **171** that is located adjacent to the operation handle **161** and is supported by the handle base **165**, and a lock operating section **172** that operates to clamp the mechanism main body **171** and release the clamping of the mechanism main body **171**. The lock operating section **172** is composed of a straight line-shaped operation rod **173** that exposes to the back side of the operating handle **161**, and a step rod shaft **174** that mounts to the operation rod **173**. A male thread (not shown) is formed in the top end of the rod shaft **174**. On the other hand, the mechanism main body **171** is configured by a block forming a slitting **175** that wraps around the handle shaft **163** in the cross-section direction. A female thread that screws together with the male thread of the rod shaft **174** is provided in the upper side of the slitting **175** (not shown), and a loose hole is formed in the lower side of the slitting **175** (not shown).

When the operation rod **173** is rotated forward and screws the rod shaft **174**, the upper portion of the slitting **175** in the mechanism main body **171** is pulled to the handle base **165** and the handle shaft **163** is clamped (lock). By contraries, when the operation rod **173** is rotated in reverse and the rod shaft **174** is loosen up, the clamping of the handle shaft **163** is released (unlock). In a series of operation for the gap adjustment, first, the lock for the operating handle **161** is released, and the gap adjustment is performed by operating the operating handle **161** while an operator is looking at the gap measurement section **154** on a display. And, after the gap adjustment, it goes to a procedure to lock the operating handle **161**. In this way of locking the operating handle **161**, a paper gap that was set does not get out of tune caused by the vibration, and the like.

The left adjustment section **151** is provided with a left end portion of the printing section **5**, that is, a left seating plate **181** on which a base of the left side of the above described stand frame **105** (one of legs) seats, a left bracket section **182** that supports the left seating plate **181** from the bottom side, a left lifting guide **183** that liftably guides the left bracket section **182**, a worm—worm wheel **184** that couples to the input section **155**, and a left cam mechanism **185** that transforms the rotation of the worm—worm wheel **184** to the lifting movement of the left bracket section **182**.

The left bracket section **182** is configured by a horizontal plate **187** that supports the left seating plate **181**, a perpendicular plate **188** that is perpendicularly formed bottom from one side of the end portion of the horizontal plate **187**, and a pair of reinforcing plates **189** that is provided to medially separate the horizontal plate **187** and the perpendicular plate **188**. Also, a long hole (not shown) in which the connecting shaft **156** of the above described interlock section **153** is loosely inserted is formed in the perpendicular plate **188**.

The left lifting guide **183** is composed of a pair of slide guide **183***a* that is fixed on the outer surface of the left side of the above described side frame **62**, and a pair of sliders (not shown) that engages to the slide guide **183***a*. The pair of sliders is fixed on the back surface of the perpendicular plate **188** of the left bracket section **182**. Therefore, in the lower half part of the side frame **62**, the left bracket section **182** is liftably configured in the state that it is protruded to the outside from the side frame **62**. By the way, the phrase "one of the support sections", which is called in the claim, is configured by the left side of the side frames **62**.

The left cam mechanism **185** is configured by an eccentric cam **191** that is coaxially provided with a worm wheel **194** of the worm—worm wheel **184**, and a cam follower **192** (roller follower) that is provided in the upper center of the perpendicular plate **188**. The eccentric cam **191** and the worm wheel **194** are provided in the left end part of the above described connecting shaft **156**, and they are rotatably supported by the side frames **62** through the connecting shaft **156**. Also, the worm **195** is provided in the end of the above described handle shaft **163**, and it is supported by the side frames **62** through the radial bearings **164**, the handle base **165**, and the installing block **167**.

When the operating handle **161** is performed forward and reverse rotation, the rotation speed of the eccentric cam **191** is reduced through the worm—worm wheel **184** and the cam follower **192** that engages to the eccentric cam is lifted in accordance with a cam curve. Because of this, the left bracket section **182** in which the cam follower **192** is mounted is lifted with respect to the side frames **62**.

The gap measurement section **154** is provided with a dial gauge **201** that is provided in the upper side of the operating handle **161**, a gauge frame **202** that supports the dial gauge **201**, and a "L"-shaped contact plate **203** (contact piece) to which a spindle **201***a* of the dial gauge **201** (measuring element) contacts. The gauge frame **202** is installed to the handle base **165**, and is supported by the side frames **62** through the installing block **167**. On the other hand, the contact plate **203** is installed to one of the reinforcing plates **189** of the left bracket section **182**. The spindle **201***a* is contracted when the contact plate **203** is lifted through the left bracket section **182**, and the spindle **201***a* is expanded when the contact plate **203** comes down so that a paper gap can be measured directly.

By the way, first, a zero-point adjustment is performed in the dial gauge **201** of the embodiment, and the zero-point is defined that the nozzle surface of the inkjet head **15** is located in a position of 2 mm to 3 mm (2.7 mm in the embodiment) from the surface of the conveyance belt **64**. Therefore, when a lifting adjustment of the printing section **5** is performed for the thickness of the introduced recording member W, it can be adjusted including a predetermined paper gap. Alternatively, the zero-point can be defined as the surface of the conveyance belt **64** so that a paper gap is indirectly measured (in this case, it is so-called platen gap).

As shown in FIG. **2** and FIG. **4**, the right adjustment section **152** has substantially the same embodiment as the left adjustment section **151** except a part of it. That is, the right adjustment section **152** is provided with a right end portion of the printing section **5**, that is, a right seating plate **211** on which the base (the other leg) of the above described right side stand frame **105** is mounted, a right bracket section **212** that supports the right seating plate **211** from the bottom side, a right lifting guide **213** that liftably guides the right bracket section **212**, and a right cam mechanism **214** that transforms the rotation of the connecting shaft **156**, which will be described later, to the lifting movement of the right bracket section **212**. By the way, the bases of the stand frames **105** in the left and right are different in size so that the left seating plate **181** and the right seating plate **211**, and the left bracket section **182** and the right bracket section **212** are respectively different in size. On the other hand, it is used that the left can mechanism **185** and the right cam mechanism are totally the same.

The right bracket section **212** is configured by a horizontal plate **216** that supports the right seating plate **211**, the perpendicular plate that is perpendicularly formed bottom from the horizontal plate **216**, and a pair of reinforcing plates **218** that is provided to medially separate the horizontal plate **216** and the perpendicular plate **217** in the same manner as the left bracket section **182**. Also, a long hole **217***a* in which the above described connecting shat **156** is loosely inserted is formed in the perpendicular plate **217**.

In the same manner, the right lifting guide **213** is composed of a pair of slide guides **213***a* that is fixed in the outer surface of the right side of the above described side frames **62**, and a pair of sliders **213***b* that engages to the slide guide **213***a*. The pair of sliders **213***b* is fixed to the back surface of the perpendicular plate **217** of the right bracket section **212**. Therefore, in the lower half of the side frames **62**, the right bracket section **212** is liftably configured in the state that it is protruded from the side frames **62** to the outside. The phrase "the other one of the support sections" called in the claim is configured by the right side of the side frames **62**.

The right cam mechanism **214** is configured by an eccentric cam **221** that is coaxially provided with the connecting shaft **156**, and a cam follower **222** (roller follower) that is provided in the upper center of the perpendicular plate **217**. The eccentric cam **221** is provided in the right end portion of the connecting shaft **156** and is rotatably supported by the side frames **62** through the connecting shaft **156**. When the connecting shaft **156** is rotated forward, the eccentric cam **221** rotates so that the cam follower **222** having the cam connection is lifted in accordance with the cam curve. Because of this, the right bracket section **212** on which the cam follower **222** is provided is lifted with respect to the side frames **62**.

The interlock section **153** is provided with the connecting shaft **156** that connects between the eccentric cam **191** of the left adjustment section **151** and the eccentric cam **221** of the right adjustment section **152**, and a pair of bearing units **225** that rotatably supports the connecting shaft **156** in both ends. The left side of the bearing unit **225** is fixed so as to penetrate the left side of the side frame **62**, the right side of the bearing unit **225** is fixed so as to penetrate the right side of the side frame **62**. That is, the connecting shaft **156** is rotatably supported in the left and right side frames **62** through the pair of bearing units **225**. The left end portion of the connecting shaft **156** is a step shaft, and in this section, the eccentric cam **191** of the left adjustment section **151** and the worm wheel **194** are subjected to a key joint (axially connect) so as to become a rotation stopper. In the same manner, in the right end portion of the connecting shaft **156**,

the eccentric cam **221** of the right adjustment section **152** is subjected to a key joint (axially connect) so as to become a rotation stopper.

By the way, needless to say, the eccentric cam **191** of the left adjustment section **151** and the eccentric cam **221** of the right adjustment section **152** are totally the same thing (cam followers **192** and **222** in the same manner), and it is preferable to make it in the same processing apparatus including a key groove formed in a shaft hole. Also, it is in the same manner for the process of the both end portions of the connecting shaft **156**.

In this manner, the left cam mechanism **185** and the right cam mechanism **214** are connected by the connecting shaft **156** in the gap adjustment section **150** of the present embodiment so that when the operating handle **161** is rotated forward, the left part and the right part of the printing section **5** can be simultaneously lifted in parallel shift. It is not necessary to control the left adjustment section **151** and the right adjustment section **152**, separately. The operation for the gap adjustment can be simplified and the gap adjustment can be stabilized.

Further, in the pair of side frames **62** that supports the medium feed mechanism **12** (belt conveyance unit **63**), the printing section **5** can be supported through the gap adjustment section **150** so that the surroundings of the main body frame **61** can be simple and compact configuration. In addition, the printing section **5** can be configured in light-weight compare to the medium feed mechanism **12** so that the configuration of the gap adjustment section **150** can be simplified by the left cam mechanism **185** and the right cam mechanism **214**, and the gap adjustment can be performed with high accuracy by the simple operations. Therefore, the printing quality (textile printing quality) for the recording mediums with various different thicknesses can be improved.

By the way, the invention can be applied to so-called line printer or a type of a printer that moves the inkjet head **15** in the X and Y directions (main scanning direction and sub-scanning direction).

What is claimed is:

1. An inkjet recording apparatus comprising:

a printing section having an inkjet head and performing printing on a recording medium;

an endless conveyance belt with an outer peripheral surface, the conveyance belt conveying the recording medium in a conveyance direction;

a support section supporting the printing section such that the inkjet head faces with the recording medium; and

a gap adjustment section having first and second adjustment sections that are placed across the conveyance belt, an input section that operates the first adjustment section, and an interlock section that interlocks the first adjustment section and the second adjustment section,

the first and second adjustment sections being movable in parallel to an adjustment direction to move the printing section in the adjustment direction and adjust a gap between the inkjet head and the conveyance belt in the adjustment direction,

the gap adjustment section being disposed lower than a lowermost portion of the outer peripheral surface of the conveyance belt in the adjustment direction.

2. The inkjet recording apparatus according to claim **1**, wherein

the first adjustment section includes a worm that is provided in the support section and is engaged to the input section, a first cam that is provided in the support section and is axially connected to the interlock section, and a first cam follower that is rotatably contacted to the first cam.

3. The inkjet recording apparatus according to claim **2**, wherein

the interlock section includes a shaft that is axially connected to the first cam in one end, and

the second adjustment section includes a second cam provided in the support section to which another end of the shaft is axially connected, and a second cam follower that is rotatably contacted to the second cam.

4. The inkjet recording apparatus according to claim **3**, wherein

the first cam and the second cam are respectively configured by an eccentric cam.

5. The inkjet recoding apparatus according to claim **2**, wherein

the input section includes an operating handle for manual operation connected to the worm, and a lock mechanism that locks the operating handle in any rotation position.

6. The inkjet recording apparatus according to claim **1**, further comprising:

a gap measurement section that measures a dimension of the gap;

wherein in the support section, the gap measurement section includes a dial gauge, in which a measuring element is provided in a contact direction of the adjustment direction, and a contact piece that is provided in the first adjustment section and contacts to the measuring element of the dial gauge.

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